Microphone Theory
AF v RF condensers

Question:

Can anybody give me a quick explanation of why RF modulated microphones are less susceptible to humidity problems than are AF microphones?

Answer:

Basically, AF capacitor microphones use the capsule as a capacitor to store charge. With one fixed plate and the other free to vibrate in sympathy with the sound, the capacitance varies, and the charge moves in or out of the capsule accordingly. This is measured by the head preamplifier and an audio signal results. All well and good, but the capsule is inherently in a high impedance circuit (over 1Gigaᐞ) – it has to sit there with stored charge until the diaphragm moves and any changes in the charge are perceived as audio. In a humid atmosphere the stored charge finds it easier to escape on water molecules in the air rather than through the input of the preamplifier, hence noisy and reduced output, and misery all round. The high biasing voltage also attracts dust particles to the diaphragm, reducing its efficiency and linearity.

The RF system (as used in Sennheiser MKH microphones) uses the capsule (a *low* impedance capsule) in a completely different way: as a tuning capacitor for an RF oscillator – which inherently employs it in a low impedance circuit where a high frequency signal is being passed through the capacitor all the time. Changes in capacitance (caused by sound moving the diaphragm) alter the resonant frequency of the circuit (circa 8MHz) and so its frequency becomes proportional to the audio signal. A simple RF demodulator restores the output to a conventional audio signal. More complex and sophisticated (but still very rugged), this system is highly immune to the effects of humidity and is thus the preferred design to be used out of doors (or when moving from outside to inside on a cold day!).